ADDITIONAL FEE:

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R E M A R K S

The Office Action issued October 27, 2004 has been received and its contents have been carefully considered.

Claim 21, the only independent claim in this application, has been amended to recite that the heat carrier circulates "in a reaction zone around a contact tube bundle...". The reaction zone (zone 62 shown in Fig. 4, for example) consists of the region inside the reactor jacket between a first tube plate 4 at the reaction gas inlet side and a second tube plate 6 at the reaction gas outlet side.

To be consistent with "the reaction gas outlet side", claim 21 has also been amended to recite "the reaction gas inlet side".

The requirement that the tube bundle consist of "single piece tubes extending through a first tube plate...and a second tube plate..., beginning and ending at the first and second tube plates, respectively, and being sealed with respect to these tube plates..." has been retained in claim

21 since, it is submitted, this feature was disclosed in the application as originally filed.

Although the drawing figures are to some extent schematic, they do show the essential features of the invention. One of the tubes - indicated in the figures by reference numeral 16 - is shown as two parallel lines, illustrating the two tube walls. In contrast, the remaining tubes are illustrated schematically (to simplify the figure) by indicating their axes only. From this illustration, it can be seen that the tubes are not fitted together from several parts, but are single piece tubes extending between the tube plate 4 at the reaction gas inlet side and the tube plate 6 at the reaction gas outlet side and having constant inner and outer diameters.

In the specification, the tubes are described as "individual tubes; e.g., 16" (See Substitute Specification, page 6, lines 5 and 6 from the bottom and page 7 lines 6 and 7). The specification thus makes clear that the tubes are formed of a single (individual) piece and not composed of several parts. Therefore, the present language of claim 21 is believed to be supported by this original disclosure.

Claim 21 has been further amended to recite "the first tube plate 4 having a reaction gas side in contact with the reaction gas and a heat carrier side." This language provides antecedent support for "the heat carrier side of the first tube plate" which appears in the next subparagraph.

Claim 21 has been further amended to delete reference to a "gaseous" heat insulation material. The heat insulation material is now limited to a solid and/or liquid material.

This insulation zone is contained in a chamber that "borders on the heat carrier side of the first tube plate" (original claim language).

Finally, claim 21 has been amended to recite that the chamber is "separated from the reaction zone by a separator plate which is penetrated by the tubes, the tube penetrations allowing for leakages." Support for this structure may be found on page 9, last paragraph of the Substitute Specification, and in Figs. 4, 6 and 7 which show the separator disk (plate) 72. As is stated there:

> "Also, possible small leakages at the tube penetrations through the separator disk 72 are not crucial in this case. Still, with regard to the reaction zone 62, about the same pressure should be maintained in the

chamber 64 in order to keep leakage streams at the tube penetrations to a minimum."

Claim 21, as previously presented, has been rejected as being anticipated by, or obvious over the U.S. Patent No. 5,048,601 to Yamaguchi et al. or the U.S. Patent No. 2,986,454 to Jewett. These rejections are respectfully traversed for the reasons given below. Applicant will first discuss the issue of novelty (35 USC §102) and then the issue of unobviousness (35 USC §103).

Novelty:

The "shell-and-tube apparatus" taught by Yamaguchi et al. clearly does not indicate a heat insulation zone that "borders on the heat carrier side of the first tube plate" with "said first tube plate having a reaction gas side in contact with the reaction gas", as recited in applicant's claim 21.

In Jewett, if the secondary tube sheet 20 is considered to correspond to the first tube plate 4 of the present invention, then the main hot tube sheet 3 corresponds to the separator disk of the present invention, which is penetrated by the tubes.

According to Jewett, the tubes are welded to the main tube sheets 3 and 4 (column 2, lines 10 to 12).

The known tube penetrations through the "separator disk" are therefore liquid-tight and do not allow for leakages. This is a necessary feature of this prior art tubular reactor, since a gaseous heat insulation material (air) is circulated in the chamber formed by the secondary tube sheet and the main hot tube sheet. The coolant circulating between the main tube sheets is not allowed to penetrate into the gas (air) chamber, nor is the gaseous heat insulation material allowed to penetrate into the reaction zone between the two main tube sheets.

The isolating tubes 23 are attached to the secondary tube sheet 20 and the catalyst tubes 8 in a <u>not completely</u> gas-tight arrangement, as may be seen from the specification, column 3, lines 1 to 4 and 14 to 23. These text passages state that the arrangement between the catalyst tube and the rolled surface of the isolating tube "will ensure a sufficiently gas-tight joint" (column 3, line 4). In order to prevent the leakage of benzene vapors into the air chamber, the air circulating through this chamber is set under slightly higher pressure than that in the inlet

chamber 15 and catalyst tubes 8 (column 3, lines 17 to 21) which, however, creates a leakage of the gaseous heat insulation material (air) into the inlet chamber 15 and the catalyst tubes 8. "Sufficiently gas-tight joint" therefore means sufficient in order to prevent leakage by a slightly higher pressure in the air chamber. This slightly higher pressure would not be necessary if the joints between the isolating tubes and either the secondary tube sheet or the catalyst tubes, respectively, were completely gas-tight.

Therefore, this known heat insulation zone is limited to the use of gaseous heat insulation material, and particularly to inert or such gaseous heat insulation material, as for instance air, which is part of the gas used for the catalytic reactions (see, e.g., column 1, lines 66 to 68).

Therefore, in addition, Jewett does not seal the tubes completely gas-tight to the tube plate which is in direct contact with the reaction gas.

Finally, Jewett fails to teach the importance of preventing leakage from the cooling medium into the tubes, which is the case with the present invention because of the single piece tubes.

In conclusion, if the main hot tube sheet known from Jewett is considered to correspond to the first tube plate according to the present invention, then the main hot tube sheet has not a reaction gas side in contact with the reaction gas and, in addition, the heat insulation zone borders not on the heat carrier side of the main hot tube sheet, but on its reaction gas side.

Unobviousness:

Yamaguchi et al disclose an intermediate tube plate between a high temperature compartment (reaction zone) and a low temperature compartment (quenching zone) (column 1, lines 32-33 and 37-38) and provide at least one insulation plate adjacent at least one side of the intermediate tube plate, in order to allow for a rapid cooling or heating and to decrease the thermal stress in the body wall near the intermediate tube plate (colujn 2, lines 30 to 39). This insulation plate forms a heat insulation zone that borders on one side of the intermediate tube plate.

However, Yamaguchi et al. do not suggest providing a heat insulation zone that borders on one side of the first (end) tube plate that separates the reaction gas inlet hood

from the reaction zone and therefore has contact on one side with the reaction gas.

Furthermore, the advantages achieved by the present invention, namely, preventing in reaction gas inlet hood secondary reactions and even ignition and deflagration (Substitute Specification, page 1, last paragraph to page 2, paragraph 2), are not mentioned at all in this patent.

Jewett addresses the problem of "avoiding such pre-ignition problems" (column 1, lines 33 to 36).

Jewett proposes to form a gas (air) chamber as a heat insulation zone, to use isolating tubes extending therethrough and to set the gas in the gas chamber under higher pressure to prevent any leakages into the gas chamber, these leakages being caused by the isolating tubes. Apart from being a very complicated and expensive arrangement, this apparatus is limited to gaseous materials to cool the secondary tube sheet, which gaseous materials must necessarily be inert or part of the gas used for the catalytic oxidation, as explained above.

The measures according to the present invention allow for a much cheaper construction and, in addition, allow for

further cost savings, as the cooling medium can be made of the same medium as the heat carrier in the reaction zone.

In conclusion, Jewett does not teach the prevention of secondary reactions and even pre-ignition with such simple features as claimed by the present invention. Yamaguchi et al. do not deal at all with the problem of secondary reactions and pre-ignition of the reaction gas in the reaction gas inlet hood. Therefore, the subject matter of the present invention cannot be considered obvious in view of these references, neither from each single reference alone nor from a combination thereof.

Accordingly, applicant's independent claim 21, and thus all of the remaining claims which depend therefrom, are believed to be novel and patentable over this prior art.

As requested by the Examiner, applicant submits herewith a new drawing page containing the amended Fig. 5.

Since all of the formal issues raised by the Examiner have been overcome by this Amendment, and since the claims distinguish patentably over the prior art for the reasons given above, this application is believed to be in condition for immediate allowance.

Respectfully submitted,

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JANUARY 11, 2005
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Date JANUARY 11, 2005